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ABSTRACT

Research concerning the euphoric state known as "the runner's high" is reviewed in an attempt to determine psychological factors behind the experience. Possible factors include cerebral dominance, relaxation, environmental influences, time and/or distance of run, and absence of personal problems. A list of references and several descriptions of "the runner's high" by those who have experienced it are appended. (CJ)

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THE RUNNER'S HIGH

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THE RUNNER'S HIGH

> Unlike a lot of runners, this one chooses to run at noon, when the sun over the shimmering blue Pacific burns hottest. The first half hour, as he trots through the seaside parks of La Jolla, is pure agony, 'exaggerated body pain and philosophical crisis.' But he knows there's relief: 'Thirty minutes out and something lifts. The fatigue goes away and feelings of power begin. I think I'll run 25 miles today. I'll double the size of the research grant request. I'll have that talk with the dean and tolerate no equivocating.' Then, another switch, from fourth gear into overdrive. 'Sometime into the second hour comes the spooky time. Colors are bright and beautiful, water sparkles, clouds breathe, and my body, swimming, detaches from the earth. A loving contentment invades the basement of my mind, and thoughts bubble up without trails. I find the place I need to live if I'm going to live.
>
> (Black, 1979, p. 79)

This effusive description of the runner's high comes not from a mystical 'running bum,' but from noted psychopharmacologist Arnold Mandell. Many runners may be able to relate times when their experience of the runner's high has been similarly exhilirating.

In reading the popular literature, one sometimes gets

the impression that every runner who puts on his or her running shoes and goes out and runs gets high. This does not turn out to be the case, however. A number of sets of findings that offered a percentage of runners that experienced the runner's high differ dramatically. Jim Lilliefors (1978), in his book The Running Mind, dealt with a select group of runners, and indicated that 78% of the runners reported experiencing a sense of euphoria during their runs. Furthermore, 49% of these runners noted that the euphoria was occasionally spiritual in nature. Sachs (1980) found that 77% of the 60 runners interviewed in his study indicated that they had experienced the runner's high.

On the other hand, there are reports of very low percentages of experience of the runner's high. In a talk given to a group of 40 runners on psychological aspects of running, the runners were asked how many had experienced the runner's high (Sachs, 1978). Only 10% indicated having experienced the phenomenon. Similarly, Weinberg (1980) found in his research that only 9% of the runners reported experiencing the runner's high.

Reasons for these drastically different percentages will be hypothesized later, but it is clear that the runner's high is not a universal phenomenon, experienced by all runners. Indeed, basic questions still exist in the construction of a suitable definition of the runner's high.

The literature on the runner's high offers at least 27

different adjectives or phrases suggested as descriptive of the runner's high. This long list includes terms such as the following: euphoria; strength; speed; power; gracefulness; spirituality; sudden realization of one's potential; catch glimpse of perfection; moving without effort; and spin out. Sachs (1980) attempted to conduct a major study on the runner's high, incorporating interviews and questionnaires to determine the nature of the runner's high and predict in whom it would occur and when and where it was most likely to happen. The following was offered as a preliminary definition of the runner's high: a euphoric sensation experienced during running, usually unexpected, in which the runner feels a heightened sense of well-being, enhanced appreciation of nature, and transcendence of barriers of time and space.

Research evidence concerning the runner's high is virtually nonexistent, primarily due to the difficulty of studying a phenomenon that supposedly occurs unexpectedly. However, one study has provided interesting findings. Wagemaker and Goldstein (1978) used EEG readings of runners before and after their runs. The EEG readings of the runners before participation were similar to those of subjects with emotional fatigue, but running reversed the process of fatigue. After running, the EEG patterns indicated the normal waxing and waning between the right and left hemispheres. Subjects indicated that they could think more clearly and that their sense of fatigue had disappeared. They felt rested, better, and could concentrate and study more

effectively. Wagemaker and Goldstein suggest that the runner's high develops after 25-35 minutes of running.

With research evidence lacking, Sachs (1980) formulated a number of hypotheses and conducted the study noted earlier. Several variables were considered in examining the runner's high.

An initial set of variables of particular interest was addiction and commitment to running. These have been the focus of earlier work by Sachs and others (Carmack & Martens, 1979; Jacobs, 1980; Morgan, 1979a, 1979b; Sachs, 1979; Sachs & Pargman, 1979a, 1979b). These researchers have noted the increased significance of psychological factors in examining participation in running, and particularly in increases in addiction to running. The runner's high has been consistently cited in the literature as a positive aspect of the running experience. It was thought likely that experience of the runner's high, representing this positive factor, would be related to increases in addiction and commitment to running. Indeed, one of the key factors in Glasser's (1976) initial development of the positive addiction concept was the Positive Addiction state, which is closely related to the concept of the runner's high.

A particularly intriguing explanation of the runner's high is that of differences in laterality of brain dominance (right/left) among runners. Glasser has suggested (Johnson, 1978) that the state of mind encountered during a run might be termed 'right-brain consciousness.' Running may provide

a classic meditation state in which the left side of the brain is left alone and may 'turn off,' permitting the right brain to 'take over.' Indeed, Ornstein and Galin (1976) note that tasks requiring use of one of the hemispheres result in increased levels of alpha (essentially a decrease in information processing) in the other hemisphere.

Mandell (Black, 1979) has also suggested that "running increases right-brain dominance." (p. 87) Clearly, descriptions of the runner's high noted earlier are those characteristic of right brain function. Numerous researchers have indicated functional differences between the cerebral hemispheres (e.g., Bever, 1975; Bogen, 1969; Gazzaniga, 1970; Ornstein, 1972). The left hemisphere is characterized by types of activities such as verbal, analytic, abstract, rational, and objective. The right hemisphere's activities are depicted as pre-verbal, holistic, symbolic, spatial, and subjective.

Although both Glasser and Mandell are cautious in noting that their speculations are tentative, the descriptions of the runner's high suggest that right brain dominant individuals are more likely to experience the runner's high. Since it is clear that there are many runners who do not experience the runner's high, left brain dominance might indicate difficulty in shifting to the right brain.

In order to test this hypothesis, it would be necessary to assess right/left brain dominance within a sample of runners and then search for differences in perceptions about

their running high. Ideally, runner's EEG function would be monitored in an effort to assess their brain wave patterns concomitant to the perception of the high. Unfortunately, this was not feasible in the Sachs (1980) study due to several factors, including difficulty in monitoring EEG function and obtaining reliable data during heavy gross motor activity.

An additional factor of potential importance is training style. 'Gentle' running (as Henderson, 1974, termed it) may often be sacrificed in favor of high, speed oriented mileage, in preparation for anticipated competitive races. Participation by most runners means the completion of a certain number of miles. Too often the emphasis is placed on speed. Running as fast as possible for a certain distance appears to be the training goal for most runners, and running 'gently' is apparently not a popular practice. It has been suggested, however, that the key to experiencing the runner's high may lie in the quality of the run, in the training style adopted by the runner. This training style may include type of run (such as long, slow distance; intervals) and 'perceptual set' (such as gentle or hard) with which the run is approached.

In discussing a phenomenological aesthetic of body awareness, Ravizza (1979) notes components of the consciousness of experience: a quiet mind, total involvement in the movement, playing to be aesthetic, and entering into the experience. The attitude towards participation is suggested as critical to heightened experience of an activity. It

might be said that the runner's attitude towards the run might underlie perceptions about, as well as feelings during, the activity. The runner's high, as an unexpected phenomenon, must be 'allowed to happen.' This can only be achieved if the individual 'let's go,' as Ravizza notes. Kleinman (1979) further points out that the emphasis must be on process (rather than product) in dealing with qualitative aspects of movement and sport.

The runner straining against the clock does not 'let go.' The judgmental self, highlighting preconceived ideas of time and distance to be covered, restricts the possibility of attaining a heightened experience (Glasser, 1976). As Lilliefors (1978) observes, relaxation is necessary before the runner's high can be experienced.

The goals of the research were two fold. First, to get a broader descriptive characterization of the runner's high. Second, to specify characteristics that would differentiate experiencers and nonexperiencers of the runner's high.

The variables noted earlier were measured with a number of questionnaires and tests. Cerebral dominance was assessed by both the Conjugate Lateral Eye Movement Test (CLEM) (Bakan, 1978) and the Your Style of Learning and Thinking Test (SOLAT) (Torrance, Reynolds, Riegel, & Ball, 1977). Addiction, commitment, training style, the runner's high, and other aspects of the running experience were assessed by questionnaires developed by Carmack and Martens (1979) and Sachs (1980).

The participants in the study were 60 regular runners from Tallahassee, Florida. A regular runner was defined as an individual who ran an average of at least four days per week, 30 minutes per day, for the past two months.

The runners averaged 32 years old, and had been running for an average of 5.7 years. Over the past 12 months they had averaged 49.9 minutes and 6.4 miles per run, with these figures increasing to 53.5 minutes and 6.8 miles for the past two months. Participants averaged 5.8 days per week running. Thirty-nine of the runners were married, with the other 21 single (including divorced). Only six of the runners were not college graduates, with four of these still in school, and almost half the runners had pursued advanced study beyond the bachelor's degree, with most having received the master's and 13 the Ph.D. degree. Occupational status was featured across 26 different job categories, with nine professors and nine graduate students being most numerous.

As noted earlier, 77% (46 of the 60 runners) indicated they had experienced the runner's high. Thirty-seven of the runners said they experienced the runner's high for a certain percentage of their runs, averaging 29.4%. The nine runners who noted experiencing the runner's high only a number of times averaged 3.5 times. Half of the runners who experienced the runner's high indicated that there were meaningful degrees or levels of the runner's high for them.

The next step was to look at our ability to predict experience of the runner's high from the variables tested, specifically cerebral dominance, addiction and commitment

to running, training style, and a host of descriptive characteristics of the running experience (such as mileage, number of races, etc.). Stepwise multiple regression and discriminant function analyses were used. Although the runner's high did not appear to be as elusive as once thought, since 36 of the 60 runners were reporting it on 30% of their runs, it was found that, given the variables tested, we could not predict experiencers from nonexperiencers. In this sense, the phenomenon of the runner's high remained as elusive as ever. Addiction to running and number of years that a person had been running did correlate positively with experience of the runner's high, however, and these do suggest possibilities for future research. But there were conflicting findings, such as the ones that suggested that the more minutes or miles one ran, the less likely it was that one would experience the runner's high. Clearly, prediction of experiencers and nonexperiencers of the runner's high is a much more difficult task than at first appearance.

With these attempts at prediction not having proved fruitful, attention turned towards further descriptive material. Clearly, the runner's high was not experienced until a high degree of physiological preparedness for running had been achieved, and the runner could run a fairly long distance without feeling pain. Evidently, it is necessary for a runner to be able to run easily and comfortably for five to 10 miles, depending on the individual, before the

runner's high becomes a part of the running experience.

Subjects appeared to be in agreement on a number of factors about the runner's high, although there were some notable differences. Many runners indicated that they had no conscious control over the experience, that it was not possible to predict when it would occur. For example, one indicated that "You can't decide to feel like this," and another noted that "You can't bring it on, control it, predict it."

Many of the runners also indicated that absence of problems, little anxiety about day-to-day affairs, and no pressure about time during the run were prerequisites to experiencing the high. For example, one runner noted the runner's high occurred when he was "not concerned about time and [there were] no major personal or job concerns on hand." Another runner echoed the idea that "you need only be relaxed and unconcerned about pace, time, or other factors requiring concentration."

Necessary physical and environmental climatic conditions suggested as prerequisites for the runner's high included cool, calm weather, an absence of hills, and running in familiar areas with few distractions (traffic, bumps). Although long runs were also indicated as necessary for experience of the runner's high, consideration of the quality of the run was mixed, with some runners noting a need to run slowly and comfortably, while others spoke of "only during

and after hard runs." But some runners indicated they could experience the runner's high in any conditions, in the rain, or in areas where the runner had never run before.

The picture presented is of a phenomenon that cannot be predicted, that is facilitated by cool, calm weather, with low humidity and few distractions, and that requires a relatively long distance (six or more miles, at least 20-30 minutes of running) at a comfortable pace (although there must be no concern with pace or time). But there are notable individual differences expressed by runners and for each runner a slightly different set of conditions may be necessary to facilitate experience of the runner's high.

Although half (23) of the runners reported experiencing different levels or degrees of the runner's high, descriptions of these levels were not clear. A dichotomous approach to understanding experience of the runner's high would suggest that there are general, lesser feelings of well being that are frequently encountered, but that there are much different euphoric states that are rarely experienced. In a continuous approach the general feeling of well being would be at one end of the continuum, and what one runner called a "super high" would be at the other.

The general feeling of well being included descriptions of "floating, effortless running," and feelings of relaxation, pleasant sensations, and drifting. Others spoke not only of these reactions, but also of the "super high," and the highest

degree being one of calm jubilation. The "super high" was further described as when you're "really into a flow, all systems are go, you're running fast but feeling effortless, there's no strain, you're almost part of the environment." A number of the runners indicated that the highest levels of this euphoric state were rarely reached.

Sime (1979) provides a report by a national caliber runner in describing the runner's high as a rare and exotic experience. The runner described his experience as:

> A highly unique transcended state wherein the other senses (sight, sound, and smell) took on peculiar degrees of sensual acuity. He described his visual experience as being somewhat similar to that which a blind man might go through shortly after having an operation which provided him with the miracle of sight, that is, a very sudden and astounding experience.

It would appear that the runner's high, as described by most of the runners, is a relatively mundane experience, in comparison with one such as that described above. The notion of the second and third wind, of feeling better during the run, may explain what most runners characterize as the runner's high. Indeed, a number of the runners spoke of the high in physiological terms, although most described it as having a psychological basis. It is important to note that each person's interpretation of his own experience is a valid one. It is inappropriate for an observer/judge to

decide that a runner is or is not "getting high." But it is important to clarify the nature of this phenomenon, and emphasize the different 'types' of high that appear to have emerged. At one end of an apparent continuum, there occurs a general feeling of well being, a vague sense of effortlessness, floating, and elation; at the other end are peak experiences such as those presented by Sime and Mandell.

Support for the definition offered earlier was indicated by most of the runners, with occasional disagreement about selected aspects, such as transcendence of barriers of time and space, and enhanced appreciation of nature. The evidence provided by the descriptions of the runner's high by the runners reinforces the definition of the term 'runner's high' as offered herein. Appendix A features descriptions of the runner's high offered by the runners. Future research may help to refine further the definition of the runner's high to include experiences at different points along the speculated continuum, from the generalized feeling of well being to the peak experience.

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What can one say about the runner's high after examining these findings, reading the literature, talking with others, and thinking about our own experiences? It appears that we are dealing with a real phenomenon. The runner's high does exist, although not everyone experiences it, and individuals experience it in different ways. It is likely that the

different percentages cited earlier are due to differing characteristics of the groups of subjects, perhaps in contrasting beginners with experienced runners, or significant differences in level of addiction or number of years running, the two variables that were shown to be related to experience of the runner's high.

As noted, we are not in a position to pass judgment that one individual is experiencing the runner's high, but another is not, even though this runner may say that he is getting a sense of euphoria. It appears that the feel better phenomenon is probably being interpreted by many runners as the runner's high, but if this is viewed as positive by these runners, and facilitates their involvement in running, then this interpretation should be encouraged.

The peak experience cited earlier has been described by Maslow (1962, 1964, 1968) as involving the following characteristics of the individual: greater integration than at other times; more able to fuse with the world; feel oneself at the peak of one's powers, using capabilities to their fullest; effortlessness and ease of functioning; active and creating center of activities and perceptions; more creative; and more spontaneous, expressive, and natural. Occasionally, as in the case of Mandell and Sime's runner, an altered state of consciousness one might term a peak experience is reported during the run. These experiences may more truly reflect the state that we think of when we

consider the runner's high. Given the comparatively frequent occurrence of the 'feel better' phenomenon, we might find it more relevant in the future to examine the peak experience in greater detail.

Although the investigations discussed herein have dealt, for the most part, with psychological studies, there is psychophysiological research in progress that may eventually provide the key to understanding the runner's high. A number of recent articles have included summaries of research into what might be termed 'the brain's own opiates' (Durden-Smith, 1978; Snyder, 1977a, 1977b; Villet, 1978). In the past few years, naturally occurring opiate-like peptides, known as the endorphins, have been discovered. Snyder (1977a) notes:

> The chemical identification of the endorphins has major relevance both for practical medical practice and a fundamental understanding of brain function. Since opiates such as morphine both cause euphoria and relieve pain, clarification of how these opiate-like peptides function will greatly advance our understanding of how the brain regulates emotions and the perception of pain. Already, it is clear that neurons containing these compounds are highly localized in 'emotional' and 'pain sensing' parts of the brain. (p. 26)

Glasser (1978) has suggested that the endorphins might be the "missing link in my research for the addictive factor

in Positive Addiction." (p. 2) He has completed research (Glasser, 1979) on the effects of blocking the action of the endorphins (through chemical means, with the drug naltrexone) on the subjective evaluations of running. No positive relationship was obtained between taking the naltrexone and reducing the pleasure of the run. Glasser suggests, however, that it was likely that not enough naltrexone was provided to adequately block the effects of the endorphins.

Mandell (1979) has further discussed potential relationships of neurotransmitters to the runner's high in his discussion of the 'second second wind.' Other recent work that is directly relevant to this area has been conducted by Appenzeller and his colleagues (Appenzeller, 1980; Appenzeller & Schade, 1979; Appenzeller, Standefer, Appenzeller, & Atkinson, 1980). Appenzeller and Schade (1979) found that, contrary to previous findings, the autonomic nervous system showed no sign of exhaustion throughout the marathon race in well-trained endurance athletes. Additionally, total plasma catecholamines and norepinephrine increased by 300 percent at seven miles, remained unchanged to 20 miles, and increased further to 600 percent above baseline levels at the end of the race.

Further work by Appenzeller, Standefer, Appenzeller, and Atkinson (1980) (also note Appenzeller, 1980) showed tremendous increases in serum beta-endorphin levels after a 45.9 km. (28.5 miles) race, reaching approximately 200 percent above pre-race figures. Although beta-endorphin

levels for participants 40 years and older were lower than levels for participants 39 years and younger, increases for both groups from pre- to post-race were statistically significant and proportionally similar.

Appenzeller et al. (1980) note the following:

> Endurance running produces a marked increase in β-endorphin. Whether this increase persists after physical activity and is responsible for the 'runner's high,' the behavioral alterations of endurance-trained individuals, improved libido, heightened pain threshold, absence of depression, and other anecdotal effects of endurance training remains conjectural. (p. 419)

Appenzeller's point is well taken, that the answers to the question of the relationship of the endorphins to the runner's high (as well as to other facets of the running experience) have yet to be determined. One question that immediately arises concerns the number of individuals who do not experience the runner's high. Does the mechanism of the endorphins somehow work differently for these runners? There is particular excitement in further research in this area, for it is here that the answers may lie to an understanding of the runner's high.

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This research still lies in the future, however, and our concerns at the moment rest on the psychological manifestations of this phenomenon. The strongest advice

one can give the clinician is to first become familiar with the anecdotal and research evidence concerning the runner's high. Noting the importance of psychological factors in running, it is then particularly valuable to assess the degree of experience of the runner's high by the clients who are running, discuss the phenomenon with these individuals, and then highlight this experience in increasing adherence behavior. The runner's high is an euphoric experience, and can and should be used to increase the benefits derived from the running experience.

For the moment, the runner's high remains a particularly personal experience, not yet readily available for scrutiny by researchers. The runner's high remains as elusive as ever, but its trail is an exciting one and will surely be followed by increasing numbers of researchers in coming years.

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APPENDIX A

Descriptions of the Runner's High

1 (BB) No trouble running, go faster, effortless.

2 (RH) Running becomes easier, smoother pace, gliding, dissociate.

4 (JH) Pleasant, dreamlike, mental drifting, floating, little awareness of external stimuli, little perception of goal directed or problem solving type of thinking.

5 (GC) Time gaps, memory lapses; "Sometimes (rarely) I just feel like I am going like a son-of-a-bitch, where I could beat the hell out of anyone in a race if I wanted to." Smell and feeling of wind, rather than sight oriented (birds waking, early morning, cried)

6 (MR) Lift in the legs, mental awareness, physical excellence, ability to suppress pain or discomfort.

7 (HG) Euphoria - free of worry, guilt, tension. Feel as if I can run forever, and fast too; hear crowds cheering as if at the end of a race.

9 (PS) At highest point, deep sense that all is well; slightly awe-inspiring feeling; simply 'tapped into' motion of universe and taken by it. oneness with motion of the universe.

#10 (PL) Taken wrong turns a few times in this state of mind.

#11 (ED) Floating, painless, detached, effortless. Running, but as if watching someone else.

#13 (FM) Sensation of floating.

#15 (AB) Pleasant, detached, euphoric feeling.

#16 (KH) Feeling of self assurance and power; rhythmic breathing without strain; gliding through air and only lightly touching down; feeling of accomplishment, that one could run forever without breathing hard or aching.

#17 (BR) Detached consciousness, sanity, integration, awareness.

#18 (JG) Feel supremely good, light-headed, and very confident.

#19 (EW) Feeling that could run forever; everything falls into place.

#22 (JM) Feelings of elation, strength, ease of movement, floating, good will, relaxed, self-confidence.

#25 (JF) Field of awareness narrows, appreciate common sensations more. See colors more distinctly on long runs. Mind wanders to pleasant things, daydream only about positive experiences.

#26 (JR) Physical effortlessness combined with euphoric, heady feeling, as opposed to feeling of well being commonly experienced.

#28 (JS) Feel like could nearly leave feet and fly. Gone as fast as could during a race, but very little

discomfort.

#31 (RH) Mind very alert, and feel aware acutely of environment. Body moving in perfect rhythm with no jerks. Ease, sense of exhiliration, joy and liberation.

#32 (BG) Conscious sense of accomplishment and well being, self-confidence, sense of worth. Not dramatic, visionary kind (only rarely a dramatically 'high' experience).

#33 (MH) Escape everything. Very aware of surroundings and physical activity involved in.

#35 (WB) Feel real good and just want to continue running.

#36 (LG) Feeling of well-being and power. Run as fast as capable for a particular distance, but not hurting as did on other days. Mental head trip that doesn't last long. Can take place in part of run and rest of run be awful.

#37 (JP) Effortless breathing, legs were light, regardless of climate felt very pleasant outside.

#38 (BR) Feel free and natural in your surroundings. At peace with being a human animal in the world.

#39 (BM) Body's efficiency, integration of mind and soul and body. Totally integrated with life (on better runs). On exceptional runs I float, glide, power along almost without effort; feel like a super being, like transcending normal

self.

#40 (JB) Feel good, light, enjoy, feel free.

#41 (RW) Feeling of self-confidence. Nothing is impossible.

#42 (WT) Good, relaxed feeling. Feel one with nature.

#43 (BM) No unpleasant feeling. Excessive amount of energy. Seems as if I could run forever.

#45 (JL) Feeling of well being.

#46 (JP) Feeling that body is moving effortlessly, and generalized feeling of well being.

#48 (ME) Good feeling, could run forever, feel very fast, no strain, body in unison.

#49 (BW) Complete joy in the run; no fatigue.

#50 (TS) Pieces (stride, breathing, fatigue, time spent, etc.) all fall together.

#51 (GM) Mind drifting off. No idea as to time and place.

#53 (CP) Euphoria, laughing and crying at the same time.

#54 (MC) Feeling that everything is clicking. Pace is smooth, relaxed, not much effort involved.

#55 (RE) Calm, feeling good, no cares at all.

#56 (HB) Enjoy run itself and closeness to natural surroundings.

#57 (MS) Sense of well being and accomplishment, and general 'all's right with the world' attitude.

#60 (MJ) Feeling of removing one's mind from thinking about discomfort body is going through.